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EPIDEMICS DON'T CAUSE WARS, BUT THEY CAN END 'EM

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ABSTRACT: THIS ESSAY EXAMINES THE BRITISH SEA-BASED AVIATION IN SUPPORT OF TWO MODERN AMPHIBIOUS CAMPAIGNS: THE BRITISH CAMPAIGN IN NORWAY IN 1940 AND THE FALKLAND ISLANDS WAR IN 1982. EXPEDITIONARY MANEUVER WARFARE (EMW) OPERATIONS AND SUSTAINABLE LITTORAL POWER PROJECTION WILL REQUIRE VERSATILE AND FLEXIBLE SEA-BASED AIRPOWER TO ESTABLISH LOCAL AIR SUPERIORITY OVER THE FLEET. WHEREAS LAND-BASED AIRCRAFT CAN ATTACK FLEETS FROM GREAT DISTANCES, CURRENT LAND-BASED FIGHTERS CANNOT PROTECT THE FLEET FROM ATTACK WITHOUT EXTENDED AERIAL REFUELING. WHEN AIR SUPERIORITY CANNOT BE MAINTAINED OVER THE FLEET, AS EVIDENCED IN NORWAY AND THE FALKLANDS, NAVAL FORCES BECOME PREY TO LAND-BASED AIRPOWER. POWER PROJECTION FROM THE SEA OCCURS AS A RESULT OF MAINTAINING LOCAL AIR SUPERIORITY, NOT IN SPITE OF IT. UNTIL A SPACE-BASED SYSTEM CAPABLE OF PROVIDING AIR SUPERIORITY FOR SHIPS AT SEA IS FIELDED, "LEGACY PLATFORMS" SUCH AS AIRCRAFT CARRIERS AND THEIR EMBARKED AIR WINGS, DESPITE THEIR HIGH COST, WILL REMAIN ESSENTIAL NAVAL WARFARE PLATFORMS. FURTHER, HOWEVER, AND PERHAPS OF GREATEST IMPORTANCE TO THIS STUDY, AMPHIBIOUS FORCES ASHORE CANNOT RELY ON AIRCRAFT CARRIER (SEA-BASED) AIR SUPPORT IF A CREDIBLE LAND-BASED AIRCRAFT OR MISSILE THREAT TO SUPPORTING AIRCRAFT CARRIERS EXISTS.

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EXECUTIVE SUMMARY

Title: Epidemics don't cause wars, but they can end 'em

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Thesis: Epidemics will not be the cause of future major wars. Military forces will remain susceptible to naturally occurring infectious diseases.

Discussion: Epidemics are a recognized threat to national security. It is assumed that an epidemic can spark a war. The causes of war are complex. There is little evidence to support the concept of disease being a direct cause. History suggests that wars cause epidemics. War cause theorists propose numerous social, political, and economic causes for war, without postulating that epidemics lead to war. Epidemics do cause MOOTW.

In an era of concern over biological and chemical weapons, naturally occurring diseases remain a serious threat to deployed military forces. Epidemics threaten national security by impacting the economic, political, and social aspects of national power. The AIDS epidemic in Sub-Saharan Africa bears stark witness to the magnitude of this threat. It also offers the opportunity for prospective study of the relationship between epidemics, state failures, and wars.

There are roughly 54 million deaths annually worldwide from infectious diseases. Half of these deaths occur in Sub-Saharan Africa. The litany of resurgent and emerging infectious diseases, coupled with the phenomenon of antibiotic resistance, bring to light the magnitude of the threat both to national security and deployed forces.

Conclusions: Political and military leaders must remain sensitive to this threat and must promote the investment of time and capital to support public health programs, infrastructure investment, and medical research. They need to be aware of the broad range of social, scientific, and political issues created by immunization programs, sexually

transmitted diseases, and the marketing of prescription pharmaceuticals. Inattention to the details of mundane programs like field hygiene, or to more esoteric topics like the impact on the military of the direct marketing of prescription drugs could spell disaster to troops in combat. An epidemic will not start a major war, but could still end one on terms unfavorable to the U.S. and its allies.

INTRODUCTION

In Marine Corps Doctrine Publication 3, *Expeditionary Operations,* there is a futuristic scenario in which U.S. military forces become embroiled in a war in West Africa that is "sparked" by a "combination epidemic of malaria and HIV."[1] The point of the scenario is to discuss how projected military capabilities may affect military operations in the future. The scenario is realistically complex, and because of this it is disconcerting. There has been much concern raised recently over the ability of epidemics to draw the U.S. into war.

Despite the seeming realism of the scenario, there is little evidence to support the concept of disease being a direct cause of war. Evidence suggests, rather, that epidemics are caused by, or are coincidental to, war. This is not to imply that epidemics are of no concern. They do pose a threat to national security, but because of their

impact upon economic, political, and social aspects of a society.

In an era of concern over biological and chemical weapons, naturally occurring infections remain a threat to military forces deployed to areas of the world where infectious disease burden is high. Epidemics are also of interest because action to quell them in their infancy can obviate the need for the use of military forces to deal with social problems.

It is counter-intuitive to assert that epidemics do not cause wars. War has many causes, with disease playing only a peripheral role. Sub-Saharan Africa's current problem with infectious diseases unfortunately offers an excellent opportunity to study the issue prospectively. There is a litany of resurgent and emerging infectious diseases that warrant the attention of politicians and military officers alike. These diseases could have devastating effects on a deployed military. It would not be the first historical example of disease changing the outcome of a war.

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[1] Marine Corps Doctrine Publication 3, *Expeditionary Operations,* (Department of the Navy, 1998) 123-136.

BACKGROUND

War, famine, pestilence, and death are the Four Horsemen of the Apocalypse. The causes of war are complex, as is war's relationship to the other Horsemen. A review of the literature on wars, failed states, and complex humanitarian emergencies reveals a litany of social, political, economic, evolutionary, psychological, mathematical, and feminist theories on their origins.[2] In most cases these theories only muddy the waters. Perhaps the most lucid explanation of the relationship between war and other calamities comes from the Prophet John in *The Book of Revelation*. The Four Horsemen ride in order and represent a causal hierarchy, with War as the instigator.[3] While John might not offer any clearer explanation of the cause of war than modern theorists, at least he succinctly explains the relationship between war, famine, and epidemics. War is an intense form of human interaction. Understanding its causes and nature are vital to its prevention, or when necessary, to its just and humane prosecution.

Disease has played a significant part in military history. Until the 20th century, soldiers were much more

[2] Attention is directed to the bibliography of this paper for more detailed explanation of these theories.

likely to die from disease in camp than wounds in combat. Likewise, wars have led to improved medicine through significant advances in public health measures and surgical techniques. Despite these advances, emerging and resurgent infectious diseases still pose a threat to military forces. The speed and complexity of modern warfare engender complacency by drawing attention away from mundane topics like field hygiene. However, emerging infections like Ebola[4] tend to draw much interest and attention. Another distraction from the fact that old-fashioned diseases can be a significant military problem is the specter of biological warfare.

Since the end of the Cold War, Weapons of Mass Destruction (WMD) have become an increasing focus of concern for United States national security. WMD are the first "challenge" to U.S. security interests noted in the 1999 National Security Strategy.[5] The collapse of the Iron Curtain has revealed an extensive Soviet nuclear, biological, and chemical weapons programs. One of the most frightening revelations came in 1992 with the defection of a top scientist from *Biopreparat*, the Soviet biological

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[3] Book of Revelation, Chapter 6, verses 1-8.
[4] Ebola is a recently discovered viral illness that is highly infectious and fatal in up to 90% of cases. Outbreaks to date have occurred in Sub-Saharan Africa. See page 37 of this paper for details.

weapons program. After signing the Biological Weapons Convention in 1972, the Soviets embarked on a program to mass-produce "weaponized" bacteria and viruses, taking pains to select organisms with antibiotic resistance and higher infectivity.[6] The availability of both product and technical expertise from the vestiges of *Biopreparat* are indeed cause for concern. Recent terror attacks like the delivery of Sarin in the Tokyo subway and Anthrax through the mail seem to validate this concern.

Biological weapons aside, *natural* infectious diseases remain a recognized National Security threat. In addition to emerging infections like Human Immunodeficiency Virus (HIV) and Ebola, there has been a resurgence throughout the world of old killers like tuberculosis, malaria, plague, and cholera. Antibiotic resistance, particularly in the case of tuberculosis and malaria, compounds the problem. Epidemics of these emerging and resurgent diseases are a threat to regional stability and are a direct threat to U.S. forces deployed to areas where these diseases occur.[7] In today's global economy and easy world travel, it is only

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[5] *A National Security Strategy for a New Century*, (The White House: December 1999.)
[6] Ken Alibeck and Stephen Handelman, *Biohazard: The Chilling True Story of the Largest Covert Biological Weapons Program in the World-Told from the Inside by the Man Who Ran It.* (New York: Random House, 1999).
[7] John C. Gannon, *The Global Infectious Disease Threat and Its Implications for the United States*,

a matter of time before an epidemic of a heretofore "exotic" disease erupts within the United States, most likely arriving innocently in a host returning from business abroad. Ironically, as the sole remaining Superpower, the U.S. has no match on the conventional battlefield, but could fall-prey to pestilence, the third horseman of the Apocalypse, as did legions of bygone eras. Therefore, it is necessary to examine the impact of naturally occurring diseases on military operations, both as a cause and an effect. Proper analysis of the current threat environment with realistic recommendations regarding force protection and consequence management is required.

EPIDEMICS DON'T CAUSE WARS

Epidemics have had tremendous impact on human history. The Black Death killed 25 million people in Europe between 1347 and 1351. Hernando Cortez' conquest of the Aztecs would have been impossible had it not been for inadvertent biological warfare: smallpox paved the way for the *Conquistadores.* It ultimately killed 20 million natives of Central Mexico in the century after 1519. The spread of this epidemic to Peru and the Mississippi River Valley

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http://www.fas.org/irp/threat/nie99-17d.htm accessed on Sep. 26, 2001.

opened the door for further European incursion into the New World.[8]

The appreciation of the historical impact of disease on war and civilization is a recent phenomenon that has spawned numerous excellent books on the subject.[9] Though not explicitly stated, these historians have demonstrated that epidemics are the *result of*, or at least coincidental to, war. Even the Plague of Athens (429 B.C.) described by Thucydides clearly began after the Peloponnesian War began and *resulted* from crowding of refugees into the city. War and disease clearly impact one another. In causal terms their relationship seems fixed: wars cause epidemics, but epidemics do not cause wars.

Any discussion about war causes requires a discussion of causality in general. First, for simplicity it must be assumed that cause and effect exist and that cause always precedes effect. Given this assumption, the next issue is proving a causal relationship. Two things may be closely related without having a causal relationship. Since this paper is about infectious diseases, it is apropos to use a medical construct for proving causality. Robert Koch (1843-1910), a German physician, is one of the fathers of

[8]Jared Diamond, *Guns, Germs, and Steel: The Fates of Human Societies*, (New York: W.W. Newton & Co., 1999) 210-212.
[9] Please see the bibliography for several of these.

germ theory and proved the causes of such diseases as tuberculosis, cholera, and anthrax. Perhaps his greatest contribution to posterity was his postulates for proving the cause of infectious disease. First, the causative organism must be present in every case of the disease. Second, the organism must be identifiable by growth in pure culture from reference cases. Third, when the pure culture is introduced into a susceptible host, it must produce the disease. Finally, the organism must again be isolated in pure culture from this new host. These postulates satisfied, the organism is accepted by the scientific community as the cause of a disease. It is a rigorous standard of causality and works well for diseases with a single cause--like infections.

It quickly becomes apparent that Koch's Postulates cannot be easily applied to more recently identified multi-factorial diseases or to complex social phenomena like war. In fact, it becomes difficult to find any historical or social example of a war cause that satisfies Koch's Postulates. It becomes necessary to hedge, and further postulate that there are "direct" and "indirect" causes of war. If there are no clearly definable direct causes of war, then there must be indirect causes. These independent variables, in differing degrees and different combinations,

are what cause war. Using medicine again as a construct, Multiple Sclerosis, a degenerative neurological disease has an unknown but statistically significant association with genetics (i.e. there is a familial predisposition), certain viral infections, and pesticide exposure. None of these agents have a demonstrated direct causal relationship; so it is postulated that the combination of infectious and environmental agents, acting upon a susceptible host, produces the disease. On one hand, these theories are scientifically unsatisfying because they lack the clarity of direct causality. On the other hand, they are enticing because they imply that removing one of the indirect causes may prevent the disease. Since war does not fit Koch's Postulates, the only alternative is to consider indirect, multi-factorial causation. The result is much less clear and satisfying, but the analysis is potentially more rewarding.

A discussion of war causes also requires a basic agreement on the scope and nature of war. No digression to the historical writings of Carl von Clausewitz or Antoine-Henri Jomini is required. Suffice it to say that wars may be major or minor in scale. They may be international, civil, ethnic, religious, or revolutionary. There will always be room for semantic arguments regarding the causes

of war, but setting parameters is best for achieving comprehension in the study of wars, state failures, and their causes.

Many theories for the cause of war have been proposed. The most palatable theories postulate uneven distributions of economic, political, or social power with war as the means to level the playing field. An offshoot of these theories is that war results when a party misperceives its military, political, or economic power relative to another; war is basically a misunderstanding. Other theories focus on evolutionary and psychological programming that favors the use of force. Some feminists theorize that war is a uniquely male phenomenon and that history would be different were it more matriarchal. There are even serious theorists that attribute aggression and war to differences in clothing.[10]

A theory related to the issue of war and disease is the "death-watch war." This is where war was caused by the death of a sovereign.[11] Still, wars of this type largely represent a problem of political instability and unclear succession rather than an epidemiological phenomenon. Even

[10] For detailed discussion of these more esoteric war causes, please see Martin A. Nettleship, R. Dalegivens, and Anderson Nettleship, *War, Its Causes and Correlates*, (The Hague/Paris: Mouton Publishers, 1975). The chapter *Clothing and Power Abuse* is found on pages 157-161.

though a monarch died during a plague, the resulting war was caused by the political situation and not by disease. Many of these theories support the aphorism “where you sit is where you stand.” The theorists are viewing the world through a single lens. No single theory has adequately explained the cause of the complex phenomenon of war. A grand unified theory of war causality does not exist. The sheer multitude of reasonable theories refutes a direct causal relationship between epidemics and major wars.

EPIDEMICS DON’T CAUSE FAILED STATES

A related issue is the concept of state failure. State failure occurs when the government can no longer maintain authority or exert political control over the population. Failed states pose concerns for regional security and frequently generate famine and epidemics that are expensive to quell. Failed states may also generate military operations other than war (MOOTW), with Somalia being the prototypical example. More recent examples can be found with Afghanistan, Bosnia, and Liberia. As with war, it is easier to demonstrate statistical correlation between failed states and disease than actual causality.

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[11] Geoffrey Blainey, *The Causes of War*, 3rd Ed. (New York: The Free Press, 1988), Ch. 5.

Despite concerns about the phenomenon, complete state failures are uncommon. During the period 1955-1994, there have been "no more than a dozen complete collapses of state authority."[12] It is difficult to draw valid conclusions from such a small set. With the scope expanded to include "partial state failures," 243 examples can be found for the same period. Analysis of 671 independent variables regarding the political, economic, and social environments in the failing state found 31 variables that were "statistically powerful" when compared to control (i.e. non-failing) states. The three best predictors of partial state failure are lack of openness to trade, higher-than-average infant mortality, and lack of democracy.[13] When these independent variables were combined for use in modeling they retrospectively predicted partial state failure approximately 70% of the time.[14] Of these correlates, only infant mortality can be easily linked to epidemics.

Given the proper political or social conditions, an epidemic could cause a partial state failure. To analyze this potential causality, modeling can be used. However,

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[12] Daniel Esty, Jack Goldstone, et al., *The State Failure Project: Early Warning Research for U.S. Foreign Policy Planning*, http://www.ippu.purdue.edu/info/gsp/FSIS_CONF/gurr_paper.html, accessed on Dec. 17, 2001, 1.
[13] Esty, Goldstone, et al., 5-6.

certain problems arise from the type of modeling used in Esty's study. First, correlation does not prove causality. Second, the study is retrospective, that is, based on historical analysis. It needs to be validated through a prospective investigation. Third, this knowledge is useful only if it predicts impending state failure early enough for intervention by the international community. At 70% accuracy, it would only detect 2/3 of failing states. And finally, the warning gained is only useful if there are suitable, acceptable, and feasible interventions. Based on the above analysis, an epidemic *might* lead to a partial state failure. Recent history has found state failure leading to MOOTW rather than major international war. Although wars and epidemics are related, epidemics don't cause wars. The arguments supporting this conclusion are, 1) historical evidence supports the opposite conclusion (i.e. that wars lead to epidemics) and 2) experts on war causes have not identified epidemics as a war cause.

EPIDEMICS DO CAUSE MOOTW

There is historical evidence that disease outbreaks, both human and animal, have generated MOOTW. The earliest example comes from the Black Death in Italy. Bernardo

[14] Esty, Goldstone, et al., 8.

Visconti, the tyrant of Milan, used his military to enforce a quarantine of a town during a plague outbreak. The quarantine failed, but the policy of using military forces to impose quarantine was adopted by neighboring city-states.[15] During the 19th century, U.S. soldiers were used to enforce quarantine of lepers in Hawaii, even using artillery to try to coerce "escapees" back into colony.[16] More modern examples include the use of the British army to assist in the quarantine and disposal of animal carcasses after a European hoof and mouth disease outbreak,[17] and plans for the Australian military to hunt down feral cattle should hoof and mouth spread to Australia.[18] Although these incidents are small in scale, they do demonstrate that epidemics can generate MOOTW. The operations noted did not degenerate into a major conflict. This adds a layer of complexity in relating epidemics and wars. Epidemics do not cause wars, but they may generate MOOTW. Is this capable of degenerating into war? So far, history has not found a causal relationship between MOOTW and major regional war.

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[15] Sheldon Watts, *Epidemics and History: Disease, Power, and Imperialism*, (Yale University Press: New Haven, 1997) 22-23.
[16] Watts, page 67.
[17] www.fas.org/ahead/disease/fmd/2001/dis-fmd-01401-eugbr.htm accessed on Oct. 8, 2001.
[18] http://news.bbc.co.uk/hi/english/word/asia-pacific/newsid_1196000/1196106.stm accessed on Oct. 8, 2001.

A confounding issue is the concept of epidemics as a threat to national security. Intelligence analysts and the White House Office of Science and Technology Policy are in general agreement that naturally occurring infectious diseases are a significant threat to U.S. national security.[19] The obvious next question is, "if epidemics don't cause wars, then why are they a threat to national security?" This belies a bias of thinking that the military is the only significant instrument of national power. Besides being a threat to individual health and well being, epidemics pose a serious economic threat. The economic element of national power can be severely impacted by disease, in terms of percentage of Gross Domestic Product (GDP) devoted to health care, reductions in productivity through lost workdays for patients and their caregivers, and loss of markets and viable trading partners. Military expenditures usually depend upon a nation's tax base. This tax base can be quickly eroded when problems develop in the sensitive global economy. From a diplomatic standpoint, as in the case of Acquired Immunodeficiency Syndrome (AIDS) in Africa, epidemics have become a focus of diplomacy for an entire continent. Even

[19] See note 6 and Presidential Decision Directive NTSC-7, The White House, Office of Science and Technology Policy at http://www.fas.org/irp/offdocs/pdd_ntsc7.htm accessed on Sep. 26, 2001.

if epidemics are not a direct cause of wars, they pose a significant threat to national security.

Weapons of Mass Destruction are currently a hot topic, and justifiably so. The world has suffered several recent, thankfully minor, attacks with both chemical and biological agents. These weapons require money, technology, and political will to both produce and employ. These incidents are frightening both to the public and world leaders. They are distinctly different from historical epidemics and conventional threats. These are man-made, employed for political reasons, and are being developed by terrorist groups and other non-state actors, not just by nation-states.

Historically, epidemics have had a much more significant impact than WMD. More importantly, medical and scientific advances have resulted in a complacent world where infectious diseases have been allowed to make a comeback. “Old” diseases like tuberculosis and malaria are currently worldwide epidemics. In the last 25 years, emerging deadly diseases like AIDS, Hantavirus, and Ebola serve as a reminder of what happens when the civilized world ignores control of diseases or fails to recognize the human susceptibility to them.

Epidemics do not lead to wars, but they have decimated forces in the field resulting in the reversal of the anticipated outcome of war. Epidemics can generate MOOTW, and by impacting other elements of national power may weaken a nation militarily. It is in U.S. national interest to quell epidemics in distant lands. Military interest is served by understanding the value of prevention and treatment of infectious diseases as a force-multiplier. This can be accomplished with force protection from pre-deployment, through deployment, and into the post-deployment period.

TEST CASE: AIDS IN SUB-SAHARAN AFRICA

The most serious threat to regional political stability by infectious diseases comes from the AIDS epidemic in Sub-Saharan Africa. This region, already prone to insoluble political turmoil, is also burdened by a number of serious infectious diseases. During the 1990's, Africa experienced significant political unrest in Somalia, Rwanda, Burundi, Democratic Republic of the Congo, Liberia, and Sierra Leone. In 1998, there were an estimated 54 million deaths from all causes worldwide. One-quarter to

one-third of these deaths were due to infectious diseases.[20] Over the first 20 years of the 21st century, "Sub-Saharan Africa will remain the region most affected by the global infectious disease phenomenon—accounting for nearly half of infectious disease-caused deaths worldwide."[21] In 2001, in Sub-Saharan Africa alone, there were 2.3 million deaths due to AIDS, 3.4 million new HIV infections, and 28.1 million people living with HIV.[22] In parts of southern Africa, HIV prevalence among pregnant women is roughly 33%. "At least 10% of those aged 15-49 are infected in 16 African countries, including several in southern Africa where at least 20% are infected."[23] Continuing complacency and ignorance regarding this epidemic bode ill for its containment in the near future. Although testing for HIV is available, many infected people remain ignorant of the fact, which hampers public health efforts. For example, "one study has found that 50% of Tanzanian women know where they could be tested for HIV, but only 6% have been tested."[24] So, in a region of the world already prone to political instability, an epidemic rages with little hope of significant improvement in the near-term.

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[20] Gannon, 7.
[21] Gannon, 14.
[22] UNAIDS/WHO-2001, *AIDS epidemic update, December 2001*, (UNAIDS: Geneva, 2001), 2.
[23] UNAIDS/WHO, 16.

Obviously, this epidemic affects the pools of available military recruits. An estimated 10-20% of Nigeria's military is HIV positive, while 40-60% of the Democratic Republic of the Congo's military is HIV positive.[25] These attack rates are higher than their respective general populations and are due to risky lifestyles of soldiers, especially on deployment away from home.[26] This heavy disease burden robs these militaries of trained, experienced officers and non-commissioned officers. It also reduces the size and effectiveness of forces available for regional peacekeeping duties. Since using African militaries for peacekeeping operations in Africa has been a common political strategy over the last several years, the likelihood that U.S. and NATO forces will be required for these duties in the future increases. It remains to be seen if the unstable political arena in Africa and the pressures from this epidemic on African militaries will lead to open war. However, historical precedent renders this unlikely. It seems more probable that the decaying political, social, and public health situations in Africa will lead to MOOTW.

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[24] UNAIDS/WHO, 17.
[25] Gannon, 34.
[26] Gannon, 34.

AIDS is not the only epidemic impacting Sub-Saharan Africa. Factors contributing to the high infectious disease burden in Africa include climate, population, lack of infrastructure, poverty, and underdeveloped health care systems. There is high prevalence of tuberculosis, with 550,000 deaths from it in 1998. Multiple-drug resistant tuberculosis is a growing problem worldwide, increasing the incidence of the disease, mortality, and the expense of treatment. Because AIDS impairs the immune system, it contributes to an increase in tuberculosis, accounting for one-quarter of the increase in tuberculosis incidence.

Sub-Saharan Africa accounts for 90% of worldwide malaria with an estimated 1 million deaths in 1998. Antibiotic resistant malaria is a growing problem. Other significant infectious diseases include cholera, dysentery, Hepatitis B and C, and meningococcal meningitis.[27] Of note is the fact that viral infections like Ebola are absent from these lists. Due to its high infectivity and mortality, Ebola generates much fear and draws media attention; however, to date outbreaks have been sporadic and relatively small. Ebola, and viral infections like it, deserve attention because of their virulence and

[27] Gannon, 14-15.

portability. The possibility of an outbreak of Ebola outside of Africa in the near future is very real.

The economic impact of infectious diseases in Sub-Saharan Africa is already being felt. It is predicted that AIDS and malaria combined will reduce Gross Domestic Product (GDP) in several countries by 20% or more by 2010.[28] The World Health Organization (WHO) estimates that small farmers in Nigeria and Kenya spend 5%-13% of their annual income on malaria treatment.[29] Estimates of the impact of AIDS-related employee turnover, absenteeism, decreased productivity, and insurance costs are mixed. A growing concern is the loss of skilled professionals from industry, medicine, and teaching. Quarantines will continue to disrupt trade. The cost of the outbreak of Bovine Spongiform Encephalopathy (BSE, also known as Mad Cow Disease) is estimated by the WHO to be $5.75 billion.[30] Other outbreaks like avian flu in Hong Kong, hoof and mouth Disease in Europe, and bubonic plague in India have caused disruptions in tourism and trade. Developing nations are being required to devote increasing portions of their GDP toward direct patient care. The result is the diversion of funds away from public health programs, education, and

[28] Gannon, 28.
[29] Gannon, 29.
[30] Gannon, 30.

infrastructure development designed to get at the root of the problem. Coupled with the increasing expense of AIDS care, this diversion of funds enhances the ability of the HIV epidemic to perpetuate itself.

AIDS has negative impact on social parameters as well. By the end of 1999, 1.7 million children in Uganda alone lost a mother or both parents to AIDS.[31] Worldwide the estimate is 41.6 million children have lost one or both parents to AIDS.[32] Of the 28.1 million people in Sub-Saharan Africa currently infected with HIV, most will die within the next decade. This will further augment the so-called "orphan cohort." Medical and social advances during the 20th century raised the life expectancy in developing countries to 64 years during the early 1990s. Current estimates lower life expectancy in Botswana and Zimbabwe to 34 years by 2010.[33] These social issues will exacerbate economic and political problems.

The AIDS epidemic in Sub-Saharan Africa provides the perfect opportunity for the prospective study of the role of disease in state failures and major wars. Partial state failures are likely in Africa over the next 20 years, whether exacerbated by disease or not. It is given, then,

[31] UNAIDS/WHO, 17.
[32] Gannon, 31.
[33] Gannon, 31.

that famine relief, disaster relief, and peacekeeping missions will be undertaken by the United Nations, regional coalitions, or individual nations. With the United States actively engaged in world affairs, and with certain military skills having demonstrated their usefulness in complex humanitarian emergencies, it is inevitable that U.S. armed forces will be drawn into MOOTW on the African continent in the decades to come.

Questions of *should* U.S. forces be involved are extremely complex and beyond the scope of this analysis. If policy makers and the general public support these missions, the military ***will*** be involved both because of its capabilities to provide logistical, communications, and medical support and its forward deployed presence. One issue is the reluctance of non-governmental organizations to accept military assistance. This reluctance stems from concerns over the appearance of partiality in civil disputes and the fact that military support is likely to be limited in time.[34] When U.S. personnel support MOOTW in Africa or elsewhere, they will be exposed to new and old infectious diseases. The ability of U.S. forces to accomplish their mission depends on their ability to

[34] Jennifer Leaning, Susan M. Briggs, and Lincoln C. Chen, *Humanitarian Crises: The Medical and Public Health Response*, (Cambridge, MA: Harvard University Press, 1999), 273-324.

operate despite this threat. Analysis of the current threats reveals that the U.S. has the capability to maintain military effectiveness in the most disease burdened areas of the world.

A PRIMER OF CURRENT DISEASE THREATS[35]

As stated before, naturally occurring infectious diseases abound and still pose significant threats to military forces. Numerous scenarios exist for the natural introduction of "exotic" diseases into the United States. Infections may spread through a natural reservoir, as is the case with the West Nile Encephalitis Virus, which normally resides in avian reservoirs and is transmitted to humans by mosquitoes. Since its appearance in North America, it has continued its geographic spread by direct contact. The incidence of this infection is unknown. Most cases are probably passed off as "the flu" and resolve spontaneously. Rare fatalities draw much attention, but seem to occur only among debilitated hosts. West Nile Encephalitis Virus demonstrates the importance of

[35] Sources for the data in this section are Abraham S. Benson, Ed., *Control of Communicable Diseases Manual*, (United States Public Health Association, Washington, D.C., 1995) and United States Centers for Disease Control, National Center for Infectious Diseases, Travelers Health and Special Pathogens Pages, http://www.cdc.gov/ncidod/dvrd/spb/mapages/dispages and http://www.cdc.gov/travel/ accessed on Dec. 29, 2001.

continuous disease surveillance and vector monitoring and control programs.

Ports of entry for infectious diseases are highly variable and include arrival in agricultural products, the ballast tanks of commercial shipping, or in the person of an international traveler. Immigrants and travelers returning from endemic areas account for the largest proportion of exotic infections in the United States. Returning U.S. military forces are a concern because they tend to deploy to some of the most epidemiologically inhospitable corners of the globe. However, these personnel usually receive high levels of pre-deployment preventive measures, on-deployment surveillance and treatment, and post-deployment observation.

More concern exists over the potential arrival of one of the emerging hemorrhagic fevers (e.g. Ebola) on a commercial airline flight to the U.S. Jet travel is faster than the short incubation period of some of these viruses. Even well trained U.S. physicians are not used to seeing these diseases and may miss the diagnosis on the first encounter. Delays in recognition will delay an epidemic's containment, increase the scope of the epidemic, and increase fear and anxiety when discovered. Subsequent

discussion in this section will focus on current and resurgent infections plus the exotic, emerging ones.

ACQUIRED IMMUNODEFICIENCY SYNDROME

By now the public health facts about AIDS and HIV are fairly common knowledge. HIV is transmitted from human to human via intimate contact. Sexual contact, shared needles, and perinatal transmission are the most common routes of infection. Antibody levels, detectable on easily administered screening tests, develop in 1-3 months. Untreated, the time from infection to the development of AIDS can be from a year to a decade. Treatment with antiviral antibiotics forestalls the progression of the disease and can be protective to individuals recently exposed to HIV. Treatment regimens are complex, expensive, and prone to side effects. Drug-resistant HIV already exists. Vaccines against HIV are in development but are proving to be highly problematic. The case fatality rate remains 100%, but with treatment life expectancy can be significantly extended.

HIV poses no immediate threat to the combat effectiveness of U.S. forces because of its long latency, mandatory annual screening for U.S. military personnel, and aggressive treatment when discovered. The prevalence of

HIV continues to increase in Africa, Central and Southeast Asia, and Eastern Europe. Sexual contact with HIV-positive prostitutes is certainly the greatest risk for deployed U.S. personnel. Ancillary issues include concern for the safety of the seldom used but still relied upon "walking blood banks."* There will likely be heated debate as to whether all U.S. military personnel should be immunized when an effective vaccine is developed. Continuous education of military personnel about HIV is the only effective preventive measure currently available.

MALARIA

Malaria is a life-threatening parasitic disease caused by four different species of the genus *Plasmodium*. Of the four types of malaria, that caused by *P. falciparum* is the most dangerous. Malaria is transmitted by the bite of the female *Anopheles* mosquito and is most prevalent in rural, tropical and sub-tropical areas of the world. The incubation period is 7-14 days. Prevention is best achieved with aggressive mosquito control programs. Spraying, elimination of standing water, use of insect repellant containing diethyltoluamide (DEET), clothing

* A "walking blood bank" refers to the use of members of a military unit as blood donors during times of crisis.

controls and the use of mosquito netting are effective preventive measures for the many mosquito borne diseases. Prophylactic antibiotic therapy remains effective in preventing malaria, but antibiotic resistance is an increasing problem. A vaccine against malaria remains experimental. Treatment with various antibiotics remains effective for cases of malaria. Untreated the case fatality rate for malaria is >10%.

TUBERCULOSIS

Tuberculosis is primarily a pulmonary infection caused by the bacterium *Mycobacterium tuberculosis.* Its natural reservoir is humans, and rarely cattle. Airborne droplets from persons with the active disease are the most common means of spreading tuberculosis. The incubation period is 4-12 weeks. Only 10% of healthy exposed persons will develop infection in the year following exposure. However, the remaining 90% will be at lifelong risk for activation if they receive no prophylactic treatment. Tuberculosis risk is global. Prevention involves periodic screening, use of prophylactic antibiotics in exposed individuals, and isolation and treatment of active cases. Antibiotic resistance is a critical issue with *Mycobacterium tuberculosis*. Because of the prevalence of strains that

are resistant to multiple antibiotics, treatment regimens are long, complicated, side effect prone, and require strict supervision for compliance. Furthermore, antibiotic resistance threatens the efficacy of current prophylactic regimens. Fortunately, tuberculosis poses no immediate threat to the combat effectiveness of U.S. military units. However, the complexity of isolation and treatment of cases and of screening exposed populations during an outbreak poses administrative and political problems. Continuous diligence of surveillance programs is required.

HEPATITIS A

A highly infectious virus causes Hepatitis A. Although the disease is usually mild and death is rare (<1/1000 clinically detected cases), an epidemic could temporarily debilitate a military unit. Risk is global. It is transmitted by fecal contamination of food and water. The average incubation period is 30 days. Treatment is supportive. Prevention is primarily proper hygiene, including hand washing, water treatment, and proper camp design. A highly effective vaccine has been recently introduced and is required for all military personnel. This immunization will obviate the need for expensive, painful pre-deployment gamma-globulin injections, which

were primarily given to prevent Hepatitis A. This immunization is an excellent example of the potential for a medical program to positively impact readiness. While the U.S. military will soon be rendered impervious to Hepatitis A, this will not obviate the need for safe supplies of drinking water and proper field hygiene to prevent a multitude of other diseases.

HEPATITIS B

Hepatitis B is a viral disease that is transmitted sexually, perinatally, or by direct contact with blood, similar to HIV. Risk is global. The incubation is 60-90 days and treatment of active hepatitis is supportive. Immunization and immunoglobulin therapy are available for recent exposures. The case fatality rate is 1-2% among hospitalized patients. Many cases go undetected. There is roughly a 20% risk of chronic Hepatitis B. Chronic Hepatitis B is common is Africa and Asia. Immunization is highly effective at preventing the disease. Military medical and dental personnel are routinely immunized, as are military personnel who are exposed (e.g. those with a sexually transmitted disease). Immunization is now offered for all newborns in the United States and is a requirement for school-aged children in many states. These aggressive

immunization programs should render this disease militarily moot for the U.S. in 10-20 years. Prevention is identical to HIV prevention with the adjunct of immunization of exposed personnel. The immunization of all U.S. military personnel is currently under consideration.

HEPATITIS C

Hepatitis C is a viral infection from the same family as Yellow Fever, Japanese Encephalitis, Dengue Fever, and West Nile Encephalitis (Flaviviridae). It is transmitted primarily by needle sharing, but can be transmitted by blood transfusion or sexual activity. Screening of donated blood for Hepatitis C is mandatory in the United States. Risk is global. Incubation is 6-9 weeks. Chronic Hepatitis C occurs in 20% of cases. Prevention is identical to HIV and Hepatitis B. No immunization is available. Treatment for acute hepatitis is supportive. The treatment for chronic Hepatitis C is complex and not always successful. Hepatitis C is an emerging epidemic whose implications for recruiting, retention, disability programs, and military operations are not fully understood at this time.

PLAGUE

Plague is a bacterial infection caused by *Yersinia pestis*. Its reservoir in the environment is rodents, and fleabites are its means of transmission to humans. Risk is global, and it is endemic in the Western United States. Incubation is 1-7 days. It is readily treated with antibiotics. Immunizations are available that provide several months protection from the bubonic plague, but not the pneumonic plague is not prevented. Infection does not generally provide long-term immunity, so re-infection is possible. If untreated, bubonic plague is fatal in 50-60% of cases.

YELLOW FEVER

Yellow Fever is a viral illness found in tropical South America and West Africa. Its environmental reservoir is primates, especially monkeys. It is transmitted to humans through the bite of the *Aedes aegypti* mosquito and its incubation period is 3-6 days. Treatment of active cases is supportive. Fatality rates range from 20-50%. Immunization is 99% effective and is mandatory for active military personnel.

INFLUENZA

Influenza is a viral infection that causes respiratory illness. It occurs worldwide. It is transmitted by airborne droplets. Incubation is 1-3 days. It is of military importance because of its ability to spread rapidly, especially in troops living in close quarters or barracks situations. It can temporarily render a unit combat ineffective. Also of concern is the fact that Influenza A can undergo mutations and cause a severe pandemic. The last influenza pandemic was in 1918 in the wake of World War I and killed 25 million people worldwide in less than a year. Immunization is 70% effective. Most fatalities occur in people over 65 years of age. There are an estimated 30,000 deaths each year in the U.S. due to influenza.

TYPHOID

Typhoid is a bacterial illness caused by *Salmonella typhi* and is transmitted through fecal contamination of food and water. Typhoid occurs globally. Humans are the reservoir and asymptomatic carriers exist. Incubation is usually 1-3 weeks. Treatment includes antibiotics and support. There are an estimated 17 million cases of

typhoid worldwide annually and 600,000 deaths. U.S. military personnel are immunized. Vaccine efficacy is good.

EBOLA HEMORRHAGIC FEVER

Ebola Hemorrhagic Fever is an emerging disease threat that has gained much press since a serious outbreak in Kikwit, Zaire (now the Democratic Republic of the Congo) in 1995. It is caused by a Filovirus. Its reservoir and method of transmission to humans remain unknown, adding to the anxiety this disease causes. In humans it is passed among household members and health care workers who have direct contact with blood and body fluids. Ebola Hemorrhagic Fever has only occurred in Africa to date. Incubation is 2-4 days. The case fatality rate ranges from 60-90% with death occurring within a week of exposure.

MARBURG HEMORRHAGIC FEVER

Marburg Hemorrhagic Fever is similar to Ebola Hemorrhagic Fever. It is also caused by a Filovirus. Its reservoir and mode of transmission to humans are uncertain, but it has been associated with the African green monkey. It is spread by contact with blood and body fluids of infected individuals. Most cases occur in Uganda and

western Kenya. Incubation is 5-10 days. Treatment is supportive. The case fatality rate is 23-25%.

RIFT VALLEY FEVER

Rift Valley Fever is a viral illness that can be severely debilitating. It comes from the same family as Hantavirus. Its reservoir in nature is cattle. It is transmitted to humans by mosquitoes and possibly other biting insects that have fed on the blood of infected animals. Rift Valley Fever occurs in eastern and southern Africa. The incubation period is 2-6 days. Recovery usually occurs in 2-3 days. Case fatality rate is 1%, but permanent partial vision loss due to retinal injury by the virus occurs in 1-10% of cases. A vaccine for use in cattle is under study.

DENGUE FEVER

Dengue Fever is caused by four different strains of Flavivirus. It is rarely fatal but produces severe debilitation and can require several weeks for full recovery. It is transmitted by the bite of the *Aedes aegypti* mosquito. Its reservoir is both humans and monkeys. Dengue Fever occurs in Asia, Africa, the Caribbean, and Central and South America. Treatment is

supportive. Infection produces immunity only to the infecting strain, making recurrent cases of Dengue Fever possible. A complication called Dengue Hemorrhagic Fever can occur with subsequent cases of Dengue Fever. Dengue Hemorrhagic Fever occurs most commonly in Southeast Asia and South America. Fatality rates of Dengue Hemorrhagic Fever can be as high as 40-50%. With appropriate therapy, fatality occurs in only 1-2% of cases. Prevention of both Dengue Fever and Dengue Hemorrhagic Fever is through mosquito control measures.

FORCE PROTECTION RECOMMENDATIONS

The preceding list contains the most prevalent infectious diseases and some of the most publicized emerging ones. It is by no means a comprehensive list of waterborne, vector borne, or sexually transmitted diseases. This list brings to light the scope and magnitude of the problem of infectious diseases worldwide. Evident also are several themes regarding prevention. While these themes are not new, their importance remains profound. Because they are not new, complacency regarding them is a real risk.

The first theme is the importance of immunizations. Ever since Edward Jenner vaccinated a milkmaid with cowpox

in 1796, the importance of immunization in health care has been increasing. Immunizations have helped reduce morbidity and mortality from infectious diseases and have helped to dramatically increase human life expectancy. As a consequence economic prosperity has increased through increased productivity. The promise of vaccines is witnessed by the extinction of smallpox in the wild. Immunization will soon lead to the extinction of polio and measles.

Unfortunately, we may fall victim to our own success. Modern Americans have become emotionally and factually ignorant of the horrors of childhood diseases. Despite demonstrated safety and efficacy, it is all too common to find people avoiding immunizations due to poverty, ignorance, and social or religious objections. Indeed, a robust mythology has developed on the subject. Beyond the concern over severe reactions, an issue is the sheer number of immunizations available. Many people find the necessity of multiple injections and boosters objectionable. These problems can be overcome with further research to improve vaccine safety and efficacy, to insure the most effective and economical booster regimen, and to allow combination vaccines that will decrease the total number of injections.

Another issue underlies numerous vaccine shortages that have occurred in the last several years. The direct marketing of pharmaceuticals to patients has led to a boom in the industry. This *has* spurred the development of new drugs. However, an unintended consequence of direct marketing has been decreased availability of "orphan drugs." Since development and marketing of prescription pharmaceuticals has become so lucrative, the financial incentive to manufacture old but effective medications that are no longer under patent has decreased. Companies would rather invest in higher profit margin medicines than eke out an existence making smaller profits on generic drugs or vaccines. This problem of drug and vaccine shortages is exacerbated when companies decide to close manufacturing facilities rather than modernize to meet Food and Drug Administration standards. This is especially true regarding parenteral (i.e. injectable) drugs, which require stringent quality control. This issue threatens the availability of medications and immunizations that are considered "basic." The question remains as to whether the free market can respond without significant gaps in availability or without significant government subsidization.

The final issue regarding immunizations is political, evidenced by the recent backlash against mandatory Anthrax

immunization of U.S. military personnel. Exaggerated concerns over safety and efficacy, coupled with shortfalls in production of the vaccine have spurred debate over the program. In part the debate is over a program targeted against a biological WMD concern rather than against a natural disease threat. At a more basic level, it is due to underlying fears over the safety of immunizations in general. The military taking the lead on vaccine research is an explosive topic. Such research would be prohibitively expensive to the Department of Defense. Even ethical, well-controlled "research on troops" is politically charged, if for no other reason than debates over its "voluntary" nature. Additionally, any such research would be conducted in the shadow of distrust cast by Agent Orange in Vietnam, secretive nuclear and disease studies during the 20th century, and Persian Gulf Syndrome.

Immunization remains a cornerstone of military health services support. Immunizations against acute diseases help preserve the fighting force and enhance combat effectiveness, especially relative to militaries that cannot afford such programs. Immunizations against chronic diseases help reduce long-term morbidity and premature mortality among veterans. An added benefit is the

reduction of health care expenses for the Department of Defense and the Department of Veterans Affairs.

A second theme evident from the list of infectious diseases is the importance of food and water safety. Americans take food and water safety for granted. The provision of safe water and provisions for our forces is of utmost importance. This militates against the purchase of rations “off the economy” in many areas of the world. The problem of making and transporting safe water rations is one of logistics. The U.S. must continue to invest in the equipment, supplies, and transport means to ensure a healthy force. The U.S. military must have adequate engineering support and invest in new equipment and technologies like the Reverse Osmosis Water Purification Unit (ROWPU).

A closely related theme is that of the importance of field sanitation. Provision of properly placed and constructed latrines should be mandatory when the tactical situation permits. The chain of command must continually emphasize hand washing before meals, even in the most austere conditions and absence of facilities. Control of mosquitoes and other insect vectors is a must. There are engineering controls like the elimination of standing water the provision of adequate shelter, proper storage and

removal of trash, and the use of traps and pesticides. There are also personal protective measures like DEET, mosquito netting, and properly worn clothing that remain the primary weapons against disease.

The prevention of sexually transmitted diseases (STD) is a morally charged issue. While education regarding abstinence should be included in all military training regarding STDs, to think it will be sufficient would be tragically naive. Additional training regarding condom usage, ensuring condom availability to troops free of charge, and the provision of a robust STD screening and treatment capability is critical.

The final theme is the importance of education, training, and discipline. Many of these infectious diseases can be prevented with simple measures. The tedium of these measures invites complacency. Repeated training and adequate supervision to ensure maintenance of order and discipline can overcome complacency.

CONCLUSION

Emerging and resurgent diseases are an enormous problem. The true magnitude of the worldwide AIDS epidemic is difficult to grasp. Its full ramifications may not be understood for centuries. The ability of microorganisms to

mutate, adapt, and resist implies that infectious diseases will remain a significant threat well into the future. Perhaps, the most recent novel approaches to dealing with infectious diseases belong to Edward Jenner, Joseph Lister, and Alexander Flemming. In this light, it seems a matter of *when, rather than if*, the next epidemic will directly impact the United States. Historical evidence and debate among social scientists suggest that epidemics do not cause wars. However, epidemics remain a threat to national security through their impact on society, politics, and economics. There is at least anecdotal evidence of a causal relationship between epidemics and MOOTW. In addition, there is statistical linkage (without proof of causation) between infant mortality and the phenomenon of state failure.

Because of its forward-deployed presence and its exceptional logistical capabilities, the U.S. military will be embroiled in the complex humanitarian emergencies and peacekeeping missions. Prevention and treatment of infectious diseases is a significant force protection issue. U.S. capabilities in this realm have been critical to our military success over the last century. The pace and violence of modern war, and the mundane (but time-tested) nature of field hygiene invite complacency. So,

while the germs are mutating, human nature is to lower the only guard available. The problem is exacerbated by political, legal, and economic factors. Examples include political fall out shutting down important military immunization programs, legal issues surrounding marketing of generic AIDS drugs in foreign markets, and the unintended consequences of the economics of prescription drug marketing. Failure to recognize these problems and mismanagement of these issues could spell disaster. An epidemic won't start our next war...but it could end it.

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